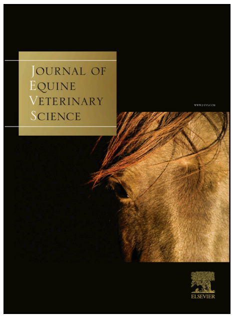
Accepted Manuscript



Investigation of Myofascial Trigger Points in Equine Pectoral Muscles and Girth-Aversion Behaviour

Annette Gwyneth Bowen, Lesley Margaret Goff, Catherine Marie McGowan

PII: S0737-0806(15)30060-5

DOI: 10.1016/j.jevs.2016.04.095

Reference: YJEVS 2093

To appear in: *Journal of Equine Veterinary Science*

Received Date: 25 October 2015

Revised Date: 24 April 2016

Accepted Date: 25 April 2016

Please cite this article as: Bowen AG, Goff LM, McGowan CM, Investigation of Myofascial Trigger Points in Equine Pectoral Muscles and Girth-Aversion Behaviour, *Journal of Equine Veterinary Science* (2016), doi: 10.1016/j.jevs.2016.04.095.

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Authors names and affiliations: Annette Gwyneth Bowen [a], Lesley Margaret Goff [b] and Catherine Marie McGowan [c].

a. BSc. Phys., MSc. Vet. Phys. annette.bowen@hotmail.com

b. PhD, MAnimSt(Animal Physio), MapplSc(ExSpSc), GDipApplSc(Manip Physio), BAppSc(Physio) School of Agriculture & Food Sciences, University of Queensland, Gatton, Australia lesley@animalphysio.com.au

c. BVSc,MACVS,DEIM,DipECEIM,PhD,FHEA,MRCVS Institute of Ageing and Chronic Disease, Faculty of Health and Life Sciences,

University of Liverpool, Leahurst, CH64 7TE, UK. C.M.Mcgowan@liverpool.ac.uk

Corresponding author's email address: C.M.Mcgowan@liverpool.ac.uk

Contributions: A.G. Bowen research and article preparation. L.M. Goff research supervision and article preparation. C.M. McGowan study conception and article preparation.

Declaration: This paper is original, it has not been submitted or published elsewhere and the final article has the approval of all authors.

Ethical Animal Research statement: All horses were assessed and treated as part of routine clinical practice and as per the regulations for the Department of Agriculture and Food, Western Australia, the data collection was considered incidental and did not require separate ethical approval.

Sources of funding: Privately funded by AB Physiotherapy Services and supported by the University of Liverpool.

Word Count: 3830 (excluding abstract, acknowledgements and references)

Abstract

Horses displaying aversion to fastening of the girth may be expressing pain from myofascial trigger points (MTrPs). The location of MTrPs in the pectoral region of horses has not been previously described. The objectives of this study were: 1) to locate and map MTrPs in the transverse and ascending pectoral muscles; 2) to score the severity of the MTrPs by behavioural reaction to palpation and; 3) to look for associations between these findings and girth-aversion behaviour. Thirty-eight horses were recruited in a cross-sectional clinical study. Taut bands were identified on palpation of horses undergoing physiotherapy assessment and then scored for behavioural reaction to palpation as normal (0), mild (1), moderate (2) or severe (3) and mapped. Owner-reported history of girth-aversion behaviour was compared with the severity score using Chi-squared analysis.

MTrPs were identified in all horses (average severity: mild n=6, moderate n=24 and severe n=8); with the most common regions of ascending pectoral muscles being the axillary and along the region usually covered by the girth. Horses with an owner-reported history of girth-aversion behaviour (n=13) had higher severity scores than horses without a history of girth-aversion behaviour (n=25; *P* = 0.014). Knowledge of the presence and location of MTrPs could assist in the development of prevention and management strategies to improve comfort, optimise performance and reduce girth-aversion behaviour.

Highlights:

- MTrPs are common in the transverse and ascending pectoral muscles.
- Horses with an owner-reported history of girth-aversion behaviour had more reactive MTrPs on palpation.
- Knowledge of the presence and location of MTrPs will assist in the development of prevention and management strategies

Keywords for publication: horse, physiotherapy, girth, muscle, saddle, palpation.

1.0 Introduction:

Girth-aversion behaviour or 'girthiness' is an adverse behavioural response to the girth being fastened. It may manifest as biting, flattening the ears, blowing out, swishing the tail, moving away and other general signs of discomfort or avoidance. Girth-aversion has been proposed to arise from a) failure of the cutaneous trunci reflex (which is conveyed along nociceptive fibres) to habituate to persistent stimulation or b) in response to pain caused by compression of the muscles beneath the saddle and girth [1]. Clinically some horses display girth-aversion behaviours during treatment of myofascial trigger points (MTrPs) in the pectoral muscles, and subsequently improve as the MTrPs are released. It has been hypothesised that horses displaying girth-aversion behaviour are expressing pain from MTrPs.

An MTrP is a harder-than-normal bundle of contracted muscle fibres and inflammatory mediators [2]. Various mechanical and nervous system stresses, such as compression, poor posture and eccentric muscle loads, are proposed catalysts [3]. The two crucial events for MTrPs to form are sensitisation of nociceptors and excessive endplate action potentials [4]. When combined in the same location they produce the four key characteristics of an MTrP, described in humans as: a taut band, painful/tender area, referred pain and local twitch response [3]. Spontaneous electrical activity (SEA) (a by-product of excessive endplate action potentials) is detectable via needle electromyography (EMG) at active MTrP sites [3]. SEA is only found in active MTrPs (not latent MTrPs) and in humans is highly correlated with reported pain intensity and pressure-pain threshold [5].

MTrPs in animals are comparable to MTrPs in humans. Although referred pain is difficult to evaluate in animals, the taut band, local twitch response and behaviour attributed to pain on palpation have been described in horses [6], dogs [7, 8], rabbits and rats [3, 9]. SEA has been recorded in equine cleidobrachialis muscle at sites determined by palpation to be MTrPs compared to no SEA at control sites [6]. The SEA recorded in horses has the same characteristics as those reported for rabbits, rats and humans [3, 6]. Fascia runs through and surrounds muscles however little is documented on the fascial component of myofascial trigger points. Horses have thick extensive fascia, the relevance of this to MTrPs and the current study is unknown.

Human studies have determined that MTrPs have tiny loci, $1.6 \pm 1.1 mm^2$ [10], with a slightly larger surrounding area that produces a pain response. Inter-tester precision for locating MTrPs in humans was found to be 6.5 - 7.6mm or approximately the width of the fingertip [11]. The more severe the MTrP the more reliable it was to locate [11]. Human studies are in agreement that pain response and pain referral are the most reliable findings [12, 3, 13]. Local twitch response is the least consistent finding, yet Hong and Simons [3] suggest it is useful to confirm diagnosis as it is often elicited during treatment. Human studies found that protocols closer to normal clinical practice produced greater agreement suggesting summation of visual observation, palpation and subject expression of pain are superior to palpation alone [13, 11].

Palpation of active MTrPs elicits pain. Animals communicate pain through their behaviour. Orthopaedic pain in horses scored by behavioural response to palpation was found to be specific, sensitive and reproducible [14]. Pain response on palpation (scored 0-5) in horses with suspected sacroiliac joint pain was significantly correlated with pressure algometry measurements of mechanical nociceptive thresholds [15]. Palpation was also strongly correlated with suspected severity of sacroiliac dysfunction [15]. Pain score on palpation (0 – 3) was a reliable outcome measure between three physiotherapists comparing palpation and algometry in horses [16].

Transverse and ascending pectoral muscles were chosen to be assessed in this study as they lie beneath the region covered by the girth. The transverse pectoral muscle originates on the sternum between the 1^{st} and 6^{th} costal cartilages, travelling to the medial humerus and antebrachial fascia; the ascending (profound) pectoral muscle has attachments to the sternum between the 4^{th} and 9^{th} costal cartilages, xiphoid process and abdominal tunic and inserts onto the craniomedial aspect of the humerus where it blends with tendons of biceps brachii, coracobrachialis and supraspinatus [17, 18, 19]. The pectoral muscles help hold the thoracic limb onto the trunk, transferring and damping ground reaction force [17]. They decelerate and stabilise the limb in late swing, controlling limb placement. During stance they support the trunk, bringing it forward over the limb which facilitates spinal flexion required for 'good posture' and hindlimb protraction [20].

Overall knowledge of MTrPs in horses is lacking. Physically MTrPs interfere with muscle lengthening and strength, while pain mechanisms inhibit muscle performance and motor control [21, 22]. MTrPs are considered to be pain-producing, so if present in the pectoral muscles could contribute to aversive behaviours when the girth is fastened. Knowledge of the presence and location of MTrPs could assist in the development of prevention and management strategies to improve comfort, optimise performance and reduce girth-aversion behaviour. Therefore, the purpose of this study was to 1) locate and map where MTrPs commonly occur in the pectoral muscles, 2) score the severity of the MTrPs by behavioural reaction to palpation and 3) look for associations between these findings and girth-aversion behaviour.

2.0 Materials and Methods:

For this cross-sectional clinical study 43 horses underwent clinical examination as part of their initial physiotherapy consultation between1st November 2014 and 31st January 2015. All assessment and data collection was performed by one qualified Veterinary Physiotherapist (AB).

2.1 Inclusion and exclusion criteria.

Horses were low level performance horses in Western Australia, mares or geldings between 12 and 18hh, 4 years and over and currently undergoing regular ridden exercise.

Horses were excluded if they: were stallions, mares in foal, were too anxious to stand square for about 10 minutes, were unridden horses (harness, young or retired), were undergoing high level discipline-specific competition, were in poor health including recent colic, had undergone previous abdominal surgery, had previous trauma to the pectoral muscles resulting in scar tissue, were currently taking anti-inflammatory or analgesic medication, or were receiving physiotherapy treatment in the last week (or regularly) that included soft tissue release through the pectoral muscles. Five horses were excluded: 1 retired, 1 unbroken, 1 stallion, 1 with previous stake injury in the pectoral region and 1 had pitting oedema in the ascending pectoral region. This left 38 study participants. One horse was receiving phenylbutazone at initial assessment so pectoral muscle assessment was delayed until follow up consultation one week later, by which time the horse had been medication free for 5 days.

2.2 Assessment Procedure.

Details for age, gender, breed, discipline, height, saddle type and girth type were taken from the case history section of the standard physiotherapy assessment form as used by author AB's practice. Questions relating to girth-aversion behaviours, side of fastening the girth and frequency of stretching the forelimb forward after fastening the girth were piloted on two owners, refined, retested and added to the assessment form (see Supplementary Information Item 1 for questions). Questions relating to exclusion criteria were added and recorded in the case history. Owners were questioned on girth-aversion behaviour prior to physical assessment.

Horses received Physiotherapy assessment and treatment in a routine professional manner, except for the following variations from usual practices which were implemented to standardise data collection. It was checked that horses had been rested for at least 1 hour prior to assessment (e.g. not ridden, lunged or groomed) and their coat was dry. Most horses were seen at the client's home but as far as possible a quiet calm environment was used to stand the horse square on a firm level surface. The horses were familiarised with palpation along the neck and shoulder as part of standard physical assessment before palpating the pectoral muscles.

The pectoral muscles were palpated with a flat hand and the pads of the fingers in a medio-lateral direction over the cranial portion of the muscle, then in a cranio-caudal direction over the caudal portion of the muscle and finally scooping into the axilla. The presence or absence of taut bands was recorded with a 1 or a 0 onto a reference map divided into cells. To confirm if an MTrP was present and to gauge its severity direct pressure was applied to each of the identified taut bands. The local and behavioural response to palpation was observed and scored 0-3; normal, mild, moderate or severe (see Supplementary Information Item 2 for full scoring details). Four horses were used for practice of palpation of the pectoral muscles and to pilot the reference map and scoring method; the map was repeatedly refined and retested for ease of use and consistency across and within the four horses. If the horse moved, the measurement was repeated. A few seconds were allowed in between applying pressure to each taut band and a scratch on the neck if necessary to return the ears/facial expression to neutral. The side of the horse assessed first was randomised by flipping a coin.

2.3 Data analysis.

Data was coded, entered into excel and double-checked, before being transferred to Minitab17 and checked for errors. Descriptive statistical summaries, girth-aversion behaviour scores and mean trigger point severity scores were produced.

2.4 Girth-aversion behaviour scores

Owners were questioned on the presence of 10 behaviours they may have observed whilst fastening their horse's girth: turning head to look at girth area, cribbing/mouthing/nibbling, attempting to bite, pawing/stamping, kicking, breath holding/blowing out, flattening ears, swishing tail, moving away and any other. Owners also reported how frequently these behaviours were displayed. The sum of the behaviours was multiplied by the frequency of the behaviour (never=0, rarely=1, sometimes=2, often=3, always=4, see Supplementary Information Item 1) to produce a girth-aversion behaviour score. Horses scoring 10 or more were classified as girth-averse and <10 non-girth-averse.

2.5 Mean Trigger point severity scores.

The sum of severity scores was divided by the number of MTrPs to produce a mean trigger point severity score for each horse. Based on these scores the horses were categorised into severity levels, scores of 0-1 represent mild, >1-2 moderate and >2-3 severe. The number of MTrPs and the mean severity for each cell was calculated for the total and girth-averse and non-girth-averse subgroups of horses and mapped. The 'Pectoral Map Generator'[1] program was used to convert rows of numbers from an excel spreadsheet into shading of the correlated cell on the image file of the pectoral map. The 'Pectoral Map Generator' program was specially created for this project and is not commercially available.

2.6 Statistical analysis.

Chi square for trend was used to test for a relationship between girth-aversion behaviour scores and mean trigger point severity scores. Data was not normally distributed so Kruskal-Wallis and Spearman's correlation co-efficient were used to test for relationships between girth-aversion behaviour, severity and demographic variables. Statistical significance was set at $p < 0.05$.

2.7 Study Power.

Sample size was estimated using mild MTrPs to represent unexposed and moderate and severe MTrP categories combined to represent exposed (ratio 0.3, percentage girth-aversion in unexposed group 1% and percentage girth-aversion in exposed group 50%). To attain power of 80% and a 95% two-tailed confidence interval (CI) 33 horses were required (EpiInfo7 cross-sectional calculator).

3.0 Results:

3.1 Descriptive data

The sample consisted of 13 mares and 25 geldings, aged 4 to 23 years (median 10, 95%CI 7.58 – 13 years), with a median height of 157cm (95%CI 153 – 162cm). Data for breed, discipline, type of saddle used, length of girth used, side of fastening girth and frequency of stretching the leg forward after fastening the girth are given in Tables 1 and 2. There was a weak positive correlation (Spearman's rho = 0.33, P = 0.043) between age and girth-aversion behaviour scores. There was a weak negative correlation (Spearman's rho =-0.32, P =0.048) between height and the number of MTrPs. There was a statistically significant difference between the number of MTrPs based on discipline (Kruskal Wallis P =0.003); horses in the disciplines of dressage and pony club had more MTrPs than other disciplines. All other combinations of descriptive variables and outcome variables were either not statistically significant or invalid due to small sample size per category (eg. only 1 subject with the girth fastened on the right side in the girth-averse category).

3.2 Common Locations of MTrPs - Combined frequency and severity

95% of horses had MTrPs in the axillary portion of ascending pectoral muscle on the right and 92% on the left, with a mean severity of severe (Figure 1). 87% of horses had MTrPs to the right of the sternum in the girth region with a mean classification of severe. High percentages of MTrPs occurred along the girth line and towards the margins of muscles, with a mean classification of moderate. Higher frequencies were positively associated with higher severity; Spearman's rho = 0.995, P = <0.01.

3.3 Owner reported girth-aversion behaviour whilst girth being fastened

The most common girth-aversion behaviour associated with fastening the girth was looking at the girth which was reported in 19 (50%) horses. This was followed by blowing out or holding of breath 16 (42.11%), then cribbing 15 (39.47%), tail swishing 12 (31.58%), flattening the ears 11 (28.95%) and moving away 11 (28.95%). Attempting to bite was less common 8 (21.05%), while other behaviours were reported in 6 (15.79%) of the horses (qualitatively described by the owners as; tossing the head, sighing and 'grumpy face'). The least frequent behaviours were pawing or kicking both 2 (5.26%). 14 (36.84%) of the horses always displayed some of these behaviours, 9 (23.68%) often, 10 (26.32%) sometimes, 1 (2.63%) rarely and 4 (10.53%) never displayed any aversive behaviours during girthing.

3.4 Girth-aversion behaviour scores

Girth-aversion behaviour scores ranged from 0 to 28 (median 6, 95%CI 4 – 8.84). 13 horses (34.21%) received a score of 10 or more and were classified as girth-averse (median 18, 95%CI 12 - 24). 25 horses (65.78%) scored <10 and were classified as non-girth-averse (median 4, 95%CI 2.19 – 5.6).

3.5 Mean trigger point severity scores

Mean trigger point severity scores ranged from 1.0 to 2.95 (median 1.54, 95%CI 1.31 – 1.71). 6 horses were categorised as mild (median 1, 95%CI 1), 24 horses were categorised as moderate (median 1.53, 95%CI 1.31 – 1.63) and 8 horses categorised as severe (median 2.42, 95%CI 2.16 – 2.68).

3.6 Girth-averse versus non-girth-averse

When grouped together in MTrP severity categories (mild, moderate or severe) there was a significant difference between horses classified as girth-averse or non-girth-averse; $P = 0.014$, (Table 3). There was also a significant difference in the mean severity of MTrPs between girth-averse and non-girth-averse horses, $P = 0.013$. Non-girth-averse horses had a mean severity of 1.45, while girth-averse horses had a mean severity of 1.89. For 70 out of the 74 cells, or 95% of the time, girth-averse horses scored a mean severity equal to or greater than non-girth-averse horses (Figure 2). There was no difference in number of MTrPs between girth-averse and non-girth-averse horses, $P = 0.1$.

3.7 Randomisation

22 horses (57.9%) were assessed first on the left side and 16 horses (42.1%) were assessed first on the right side. There was no significant difference in number of MTrPs, $P = 0.10$, or severity of MTrPs, $P = 0.42$, between horses assessed first on the left or the right.

4.0 Discussion:

MTrPs were located in all horses in this study with the most common site being the axillary portion of the ascending pectoral muscle. The ascending pectoral muscle is a large muscle (~2.8kg each [17]) that narrows down to a small insertion on the cranio-medial aspect of the humerus. The muscle twists from trunk to limb; when combined with girth pressure and eccentric work this may create a site of stress predisposed to MTrP development. The girth does not lie over the axillary portion of ascending pectoral muscle; however the girth could have a tethering effect over the middle of the muscle, restricting lengthening of the muscle during forelimb protraction and therefore increasing stress towards the muscle insertion in the axilla. In the region between the forelimb and the trunk several layers of fascia converge, contributing to an extensive web of attachments and sources of tension or dysfunction potentially affecting this region.

MTrPs were common to the right of the sternum; this may be related to laterality or the natural crookedness of horses. It has been suggested that passage through the birth canal distorts the ribcage at its widest point and leads to asymmetrical adaptations in the horse [23]. Mild asymmetry may place the sternum slightly off centre, and skew the pectoral muscles. Furthermore many equine handling practices including mounting are one-sided. This may be a factor contributing to asymmetrical distribution of MTrPs. It is English riding convention to fasten the girth on the left. This may pull the skin and pectoral muscle muscles towards the left, bunching and pinching them against the right side of the sternum. This action and compression may irritate the region sufficiently to induce MTrPs.

The cutaneous trunci overlies the lateral edge of ascending pectoral muscle which was another common site for MTrPs. This is the thickest part of cutaneous trunci [1] - Essig et al. [24] suggest stimulation produces a bigger twitch where the muscle is thicker. Stretching the forelimb forward may produce reflex relaxation of the cutaneous trunci and lessen irritation [1]; however the current study found no statistical difference between owner-reported frequency of stretching and any of the outcome measures. The possible benefit of stretching would be better assessed with a treatment based study. There is moderate evidence in humans that stretching effectively decreases pain associated with MTrPs [25, 26].

There were a large number of MTrPs across the middle of ascending pectoral muscle and caudal edge of transverse pectoral muscle. This is the region the girth lies over so the relationship between girth design and MTrPs warrants further investigation. Girth-averse horses had higher severity of MTrPs in the region behind the elbow; this is similar to where Murray et al. (2013) [20] recorded the highest pressure under normal girths. The pressures in this region peak during unilateral stance [20]. The pectoral muscles perform multiple functions during stance phase of gait which may be hampered by compression from a girth. Compression can restrict muscle lengthening and reduce blood flow producing localised ischemia [27, 28]. The Fairfax girth, which is cut back around the elbow, was found to allow an increase in stride length, hock and carpal flexion when compared to a normal girth [20]. These changes in limb movement may be partly due to decreased pressure on MTrPs. Investigation of long term use of a cut back girth is warranted as it may decrease MTrP severity in these locations and in turn decrease girth-aversion behaviour.

Girth-averse horses had higher mean MTrP severity scores. MTrPs produce signs of pain both spontaneously and when palpated. The presence of MTrPs in muscles in the girth area offers one explanation for aversive behaviour on fastening the girth. Horse owners often attribute behaviour to reasons other than pain, such as ill will [29]. Compared to veterinarians, owners are found to underestimate back pain [29] and lameness [30]. Nondisclosure of pain is a survival mechanism for prey animals, however, when horses are restrained aggressive behaviour is strongly associated with pain [31]. Girth-aversion behaviour such as biting and kicking can be dangerous for handlers. Owners, handlers and riders should be more aware that girth-aversion behaviour may be associated with MTrPs and therefore horses may be expressing musculoskeletal pain and the source of pain should be identified and addressed.

Three horses in the severe category were categorised as not girth-averse. Physical examination findings were gathered from one time point only, yet owners were asked to reflect over time how their horse on average behaves during girthing. It may be that the MTrP pain was acute and therefore the owners hadn't noticed a sustained display of girth-aversion behaviour. Perhaps these horses were expressing their MTrP discomfort whilst ridden rather than during girthing. Two horses with high girth-aversion scores had moderate severity scores. One had been gelded in the previous year and still displayed some stallion behaviours. The other had a previous history of poor saddle fit so the girth-aversion behaviour may have become habitual even though the anticipated pain no longer occurred with the better fitting saddle.

The weak positive correlation between age and girth-aversion behaviour score suggests that older horses displayed more girth-aversion, which may relate to cumulative painful experiences. The weak negative correlation between height and MTrPs is possibly a novel finding. The observed differences in frequency of MTrPs between disciplines may be due to the wide variety of workloads, tack and training methods being utilised.

A potential limitation of this study was the sample size being too small to detect associations between some of the descriptive variables and outcome variables. Actual occurrence varied from the estimates (ratio 0.18, percentage girth-aversion in unexposed group 0% and percentage girth-aversion in exposed group 40.62%), suggesting 57 horses would have been required to achieve the same power. Cross-sectional studies sample data at one time point, so it cannot be said that MTrPs are causing girth-aversion behaviour, just that both are present in these horses. There may be another factor causing both, for example, poor saddle fit, back pain or gastric ulceration. There are many possible ways of assessing whether horses are girth-averse. Questioning owners is vulnerable to recall bias. Horses tended to cluster towards non-girth-averse low scores or towards girth-averse higher scores i.e. if they attempted to bite they also tended to demonstrate other behaviours.

The strengths of this study were that the assessments were carried out under real clinical situations, so the generalisability of the results to practice is high. The lack of difference in number or severity of MTrPs based on the left or the right side being assessed first suggests there was no order effect and that the single assessor was able to maintain consistency. Multiple characteristics were examined to identify MTrPs and the cells of the reference map were large enough to encompass several MTrPs.

Further research should investigate the function of the pectoral muscles during locomotion and posture. Larger samples and different study designs could examine possible contributing factors and their temporal relationships. For instance would a program of regular forelimb protraction stretching reduce the number and severity of MTrPs (and reduce girth-aversion behaviour) and what is the effect of back pain, saddle or girth shape and fit, lameness or the presence of stomach ulcers?

5.0 Conclusion:

MTrPs are very common in the axillary portion of ascending pectoral muscle, to the right of the sternum, through the girth region and towards the edges of muscles. Horses displaying girth-aversion behaviour had more severe trigger points. This sample was too small to draw correlations between other possible contributing factors. Physically MTrPs interfere with muscle lengthening and strength, while the pain from MTrPs also inhibits muscle performance and motor control. Knowledge of the presence and location of MTrPs could lead into the development of efficient management strategies and prevention, improving comfort for ridden horses, optimising performance and reducing girth-aversion behaviour.

Conflict of Interest Statement: The authors have declared no conflicting or competing interests.

Acknowledgments:

Thank you to: Rose Bowen for assisting with data entry and editing. Ben Chandler for creating the Pectoral Map Generator. Charlotte Steed and Paula Robinson for their help in editing.

Manufacturer's details:

[1]Pectoral Map Generator software written by Ben Chandler, Doodlakine, Australia.

Supplementary Information Items:

1. Girth-aversion Behaviour Assessment Form (Appendix 1)
2. Behavioural Response to Palpation Scoring (Appendix 2)

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Figures and Titles:

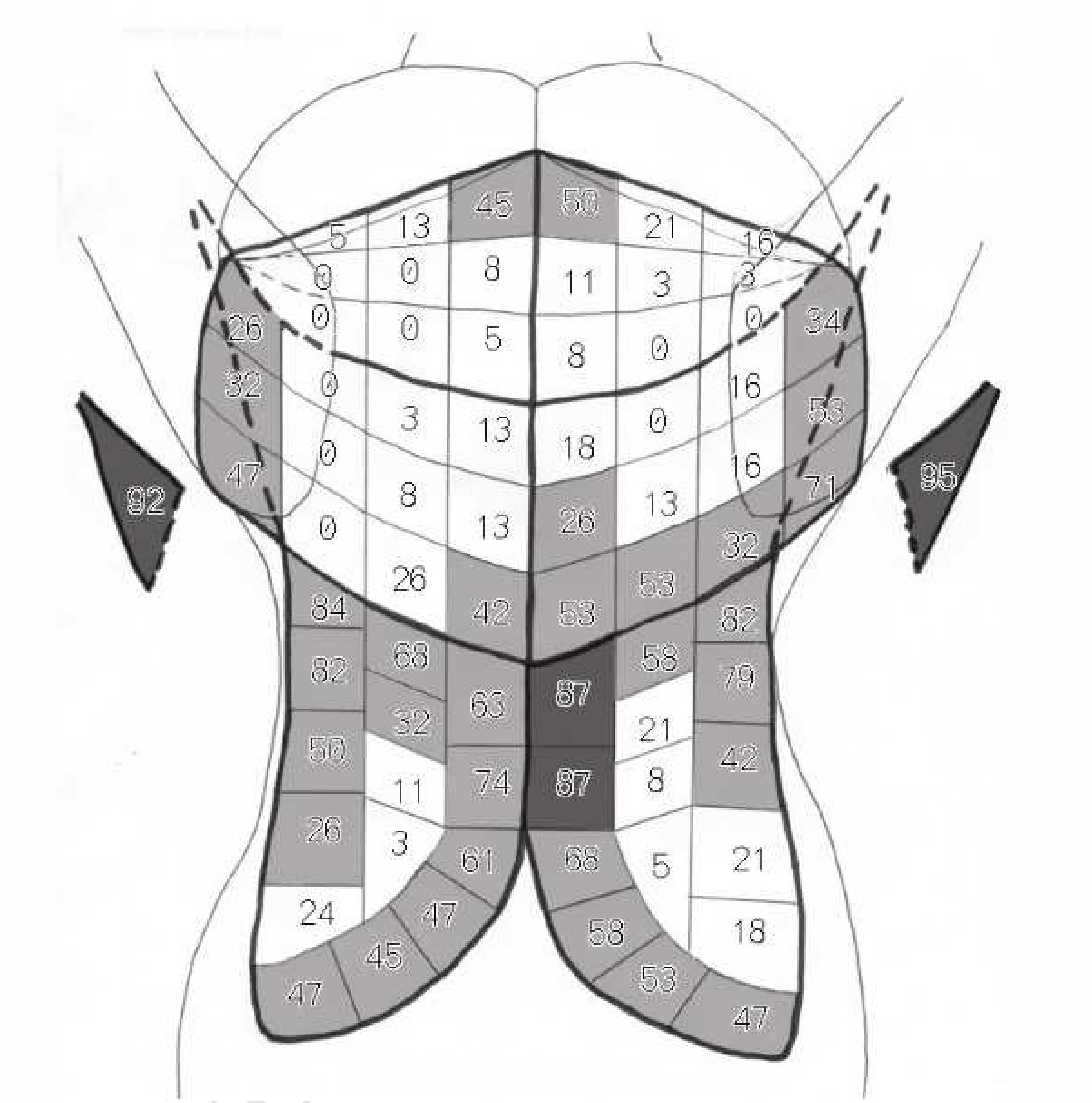

Figure 1: Map of transverse and ascending pectoral muscles viewed ventrally (cranial at the top of the page, left forelimb towards the left of the page); Frequency and severity of MTrPs in 38 horses. Shading = average severity, White: mild 0-1, Light grey: moderate >1-2, Dark grey: severe >2-3. Overlaid numbers = percentage of horses with an MTrP for each cell.

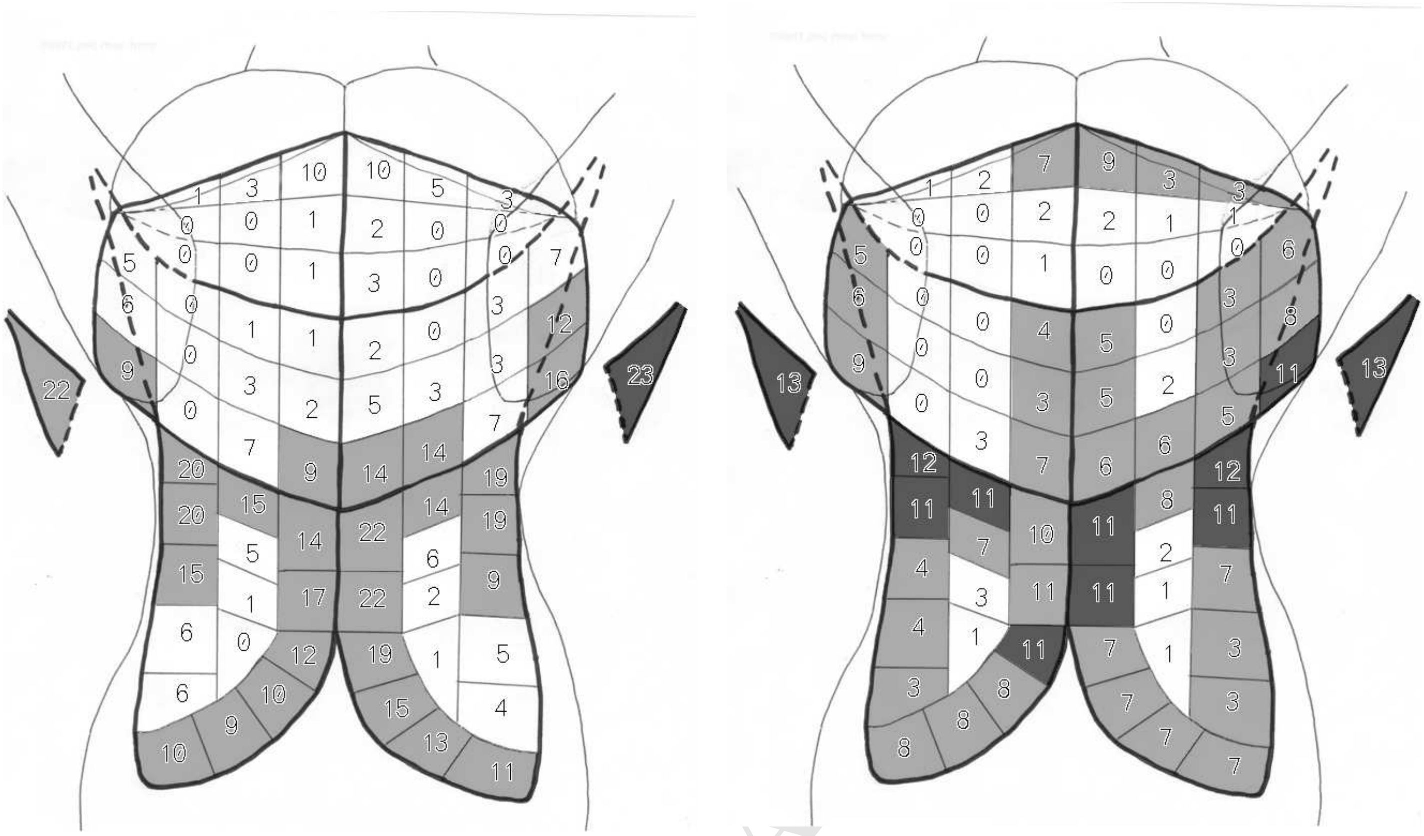

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Figure 2: Map of transverse and ascending pectoral muscles viewed ventrally (cranial at the top of the page, left forelimb towards the left of the page). Frequency and severity of MTrPs in a) 25 non-girth-averse horses and b) 13 girth-averse horses. Shading = average severity, White: mild 0-1, Light grey: moderate >1-2, Dark grey: severe >2-3. Overlaid numbers = number of horses with an MTrP for each cell.

652 Tables and legends:

653 Table 1: Description of breed and discipline in 38 horses; count (percentage)

Breed		Discipline	
Thoroughbred	13 (34.21)	Pony Club	12 (31.58)
Arab/cross	5 (13.16)	Pleasure	12 (31.58)
Welsh/cross	5 (13.16)	Dressage	5 (13.16)
Quarter horse cross	3 (7.89)	Eventing	5 (13.16)
Mixed breed	3 (7.89)	Showjumping	2 (5.26)
Australian Stock Horse	3 (7.89)	Camp drafting	2 (5.26)
Riding pony	2 (5.26)		
Cleveland Bay x Thoroughbred	2 (5.26)		
Thoroughbred x Quarter horse	1 (2.63)		
Warmblood x thoroughbred	1 (2.63)		

654

655 Table 2: Description of type of saddle, type of girth, side of fastening the girth and
656 frequency of stretching the forelimb forward after fastening the girth in 38 horses;
657 count (percentage)

Type of Saddle		Type of Girth		Side of Fastening		Frequency of stretching	
Dressage	12 (31.58)	Long	18 (47.37)	Both	18 (47.37)	Regularly	15 (39.47)
All purpose	12 (31.58)	Short	17 (44.74)	Left	16 (42.11)	Never	12 (31.58)
Jumping	6 (15.79)	Both	3 (7.89)	Right	4 (10.53)	Sometimes	11 (28.95)
More than one	5 (13.16)						
Other	3 (7.89)						

658

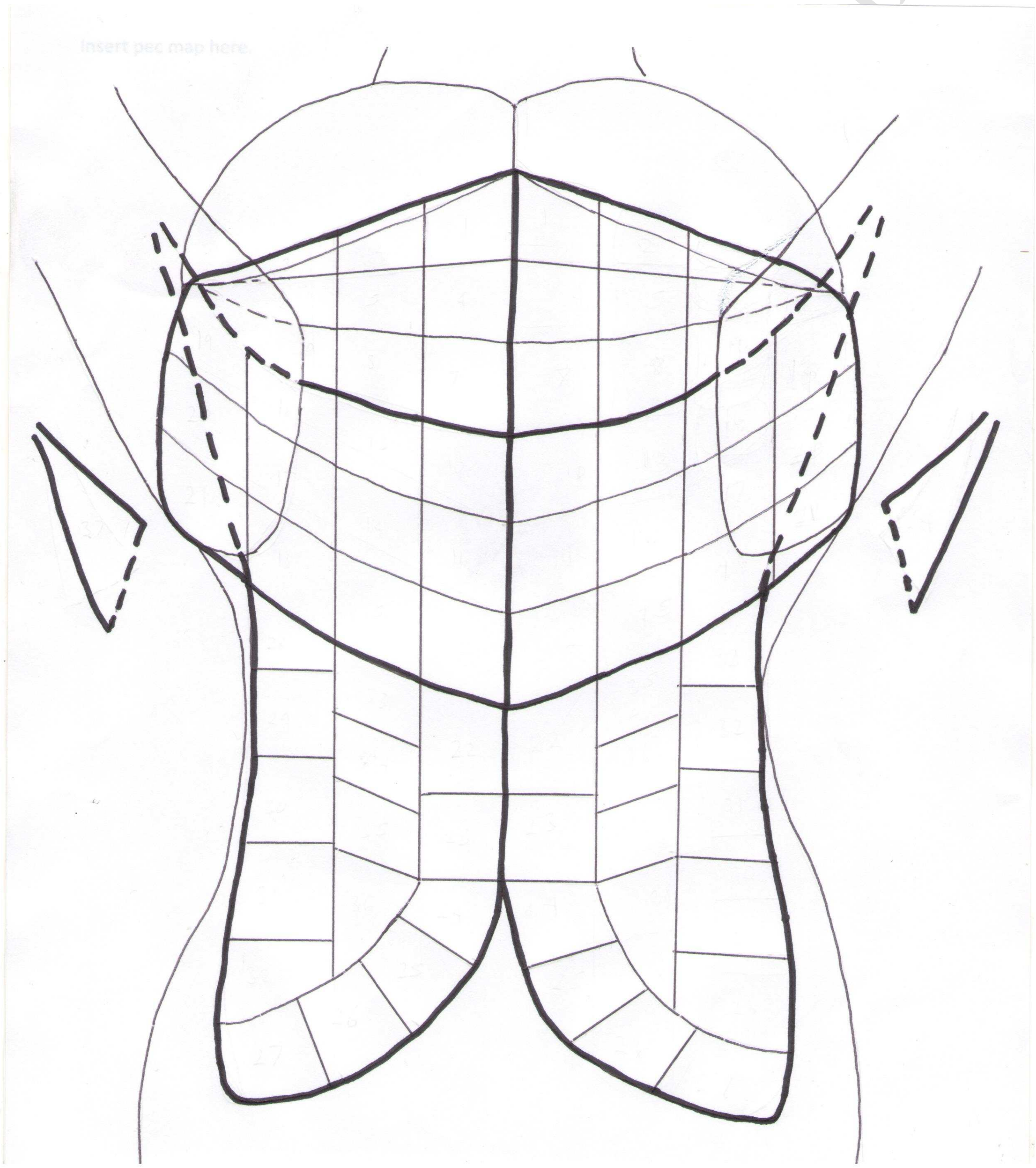
659 Table 3: Categorised of girth-aversion status and myofascial trigger point (MTrP)
660 severity in 38 horses.

	Mild MTrP severity	Moderate MTrP severity	Severe MTrP severity	Total
Non-girth-averse	6	16	3	25
Girth-averse	0	8	5	13
Total	6	24	8	38

661

Supplementary Information Item 1

1) When being girthed does your horse do any of the following: turn his head to look at the girth area, crib/mouth/nibble, attempt to bite, paws ground/stamps, kicks, holds breath/blows out, flattens ears, swishes tail, moves away, other:
2) How often does your horse exhibit any of these behaviours: Never Rarely Sometimes Often Always
3) Do you fasten your girth on the left or the right? Left Right Both
4) Do you regularly stretch your horses leg forward after fastening the girth? No Sometimes Yes
5) Map taut bands no = 0, yes = 1, tear = 2 6) Behavioural response 0/1/2/3



Supplementary Information Item 2

Behavioural Response to Palpation to gauge severity of trigger point

(eg. tenderness on palpation/ hypersensitivity, pain (referred?), local twitch)

0 = normal: pain-free reaction to palpation/pressure sensation

1 = mild: a few mild facial or behavioural indicators, +/- local reaction

2 = moderate: several moderate facial and behavioural indicators and a local muscle reaction

3 = severe: severe facial, behavioural and local reaction, withdrawal, aggression.

Signs of pain/ trigger point:

Local reactions: local twitch, spasm, fasciculation, local movement – muscle contraction, withdrawal = sternal lift/reflex (small, medium, large)

Facial expressions: dilation of nares, breath holding, nose wrinkling, aggressive snorting
Brief rapid caudal ear movement, sustained ears back, ears flattened/pinned
Lips tightening, clenched jaw, teeth bearing, teeth grinding
Rapidly turns eye towards, fixed stare/ not blinking, rolls eye/ looks out of top part of eye/ eyes puckered slightly

Behavioural responses: rigid stance, lift leg/ rising hindleg, stamping foreleg, restless, kicking
Head jerk, head and neck very high, rearing
Head turn, head and neck turn, neck low and snaking, biting
Tail swishing, tail flattening, tail lashing
Stepping away, swinging hind quarters, walking through handler/pulling on tie, plunging/escape/bolt

Behavioural signs of a treatment effect/ enjoyment: closing eyes, sticking top lip out, nuzzling, lowering head, deep breathing, leaning into palpation; will be assumed evidence for the presence of a MTrP and therefore scored a 1.

Scoring system developed with reference to:

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Highlights: 3-5 bullet points.

- MTrPs are common in the transverse and posterior pectoral muscles.
- Horses with an owner-reported history of girth-aversion behaviour had more reactive MTrPs on palpation.
- Knowledge of the presence and location of MTrPs will assist in the development of prevention and management strategies